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Kollmann et al.

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[54] **TELESCOPIC BOOM**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **212/55**

[51] **Int. Cl.** **B66c 23/06**

[58] **Field of Search** 212/55

[56] **References Cited**

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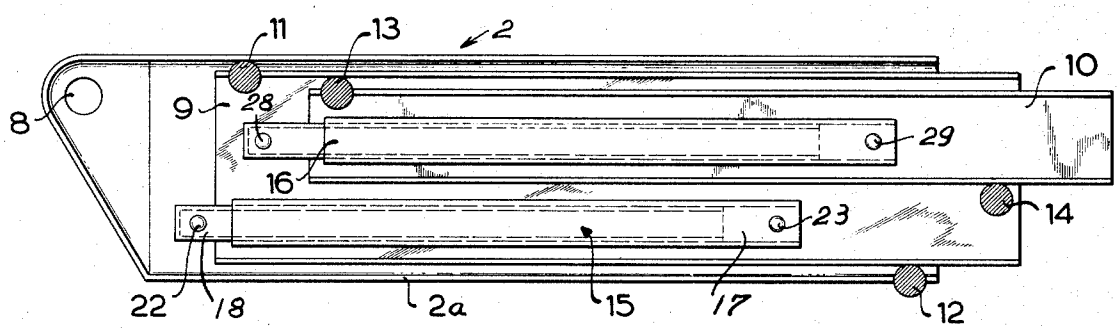
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[57] **ABSTRACT**

A composite boom having a boom section pivotally connected to a supporting member and also having a boom means telescopically movable into and out of said boom section while hydraulically operable cylinder-piston means arranged in telescopically movable housing elements are operable to actuate said boom means through the intervention of at least one of said housing elements, said hydraulically operable cylinder-piston means including serially arranged cylinder and pistons.

4 Claims, 9 Drawing Figures



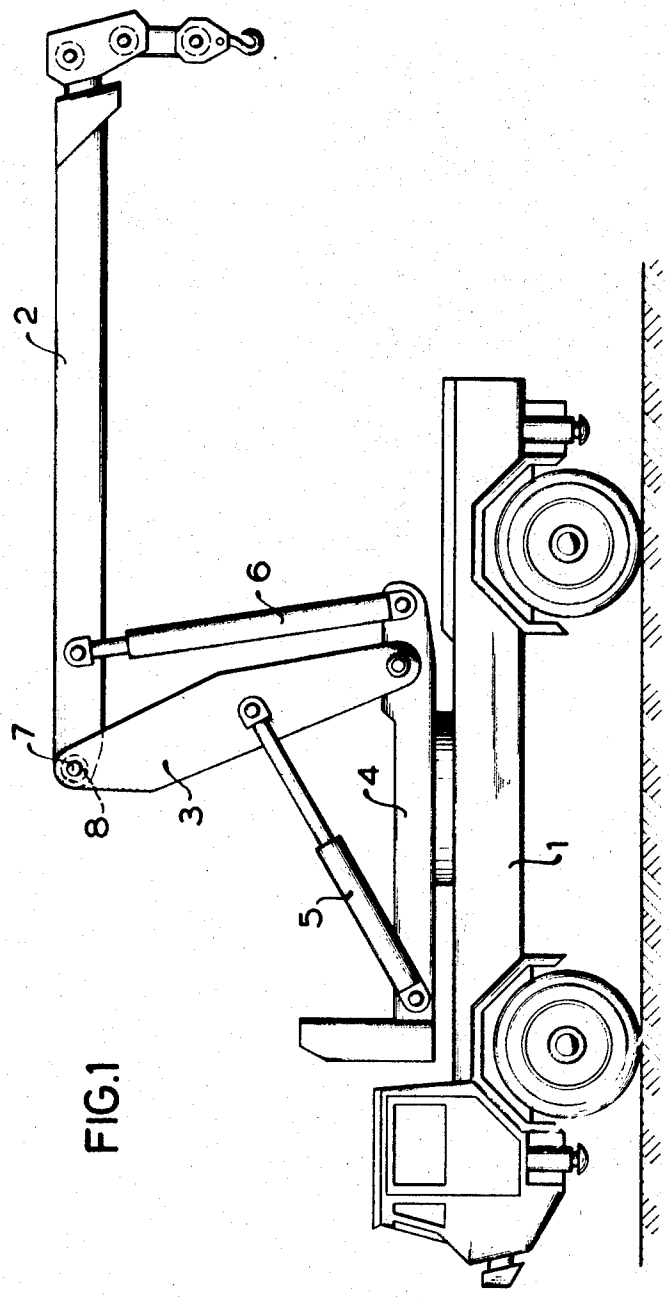


FIG.1

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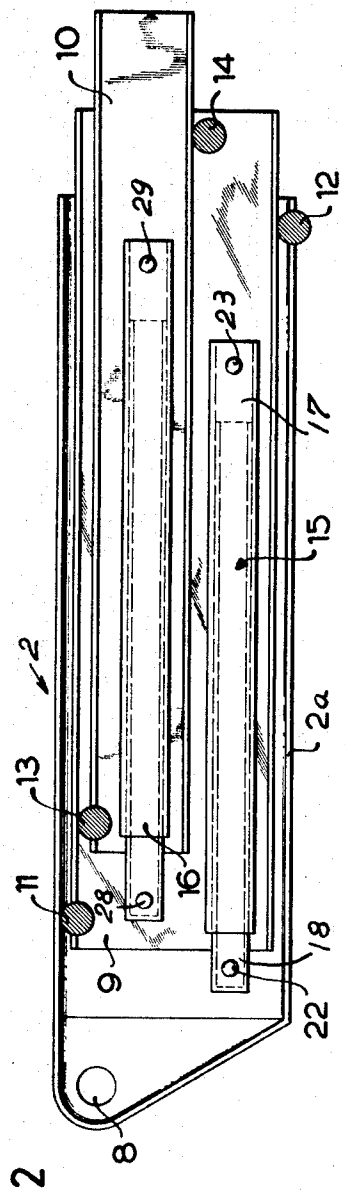


FIG. 2

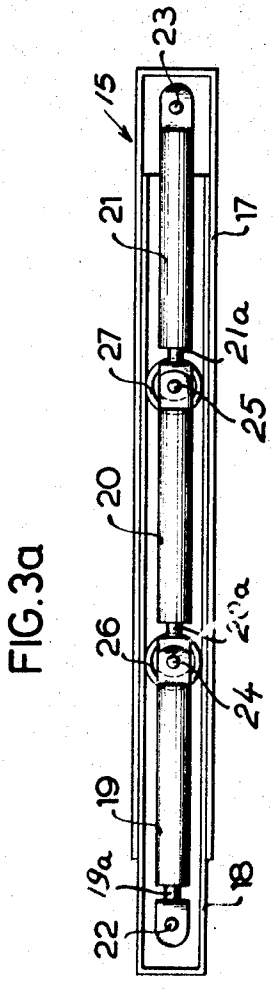


FIG. 3a

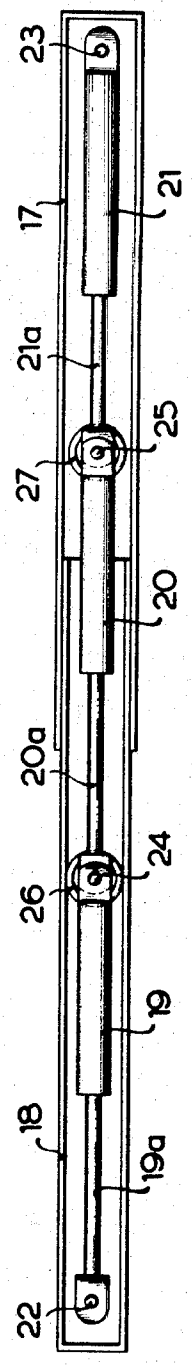


FIG. 3b

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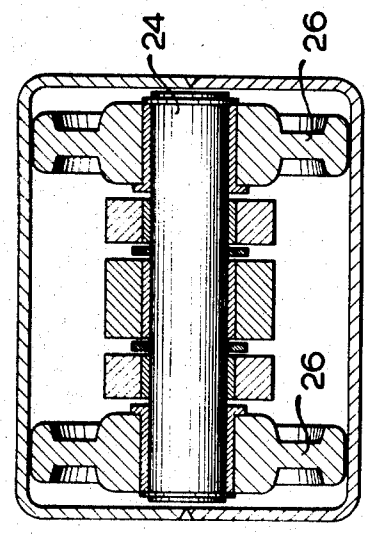


FIG. 4c

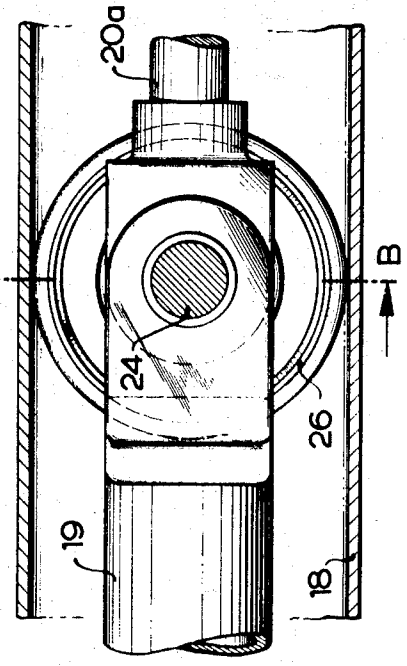


FIG. 4a

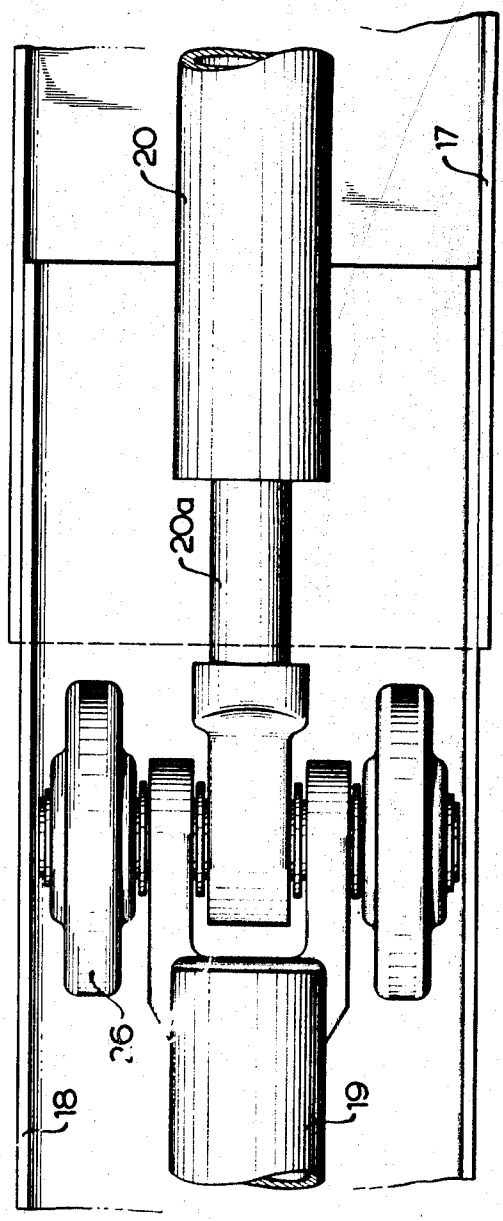


FIG. 4b

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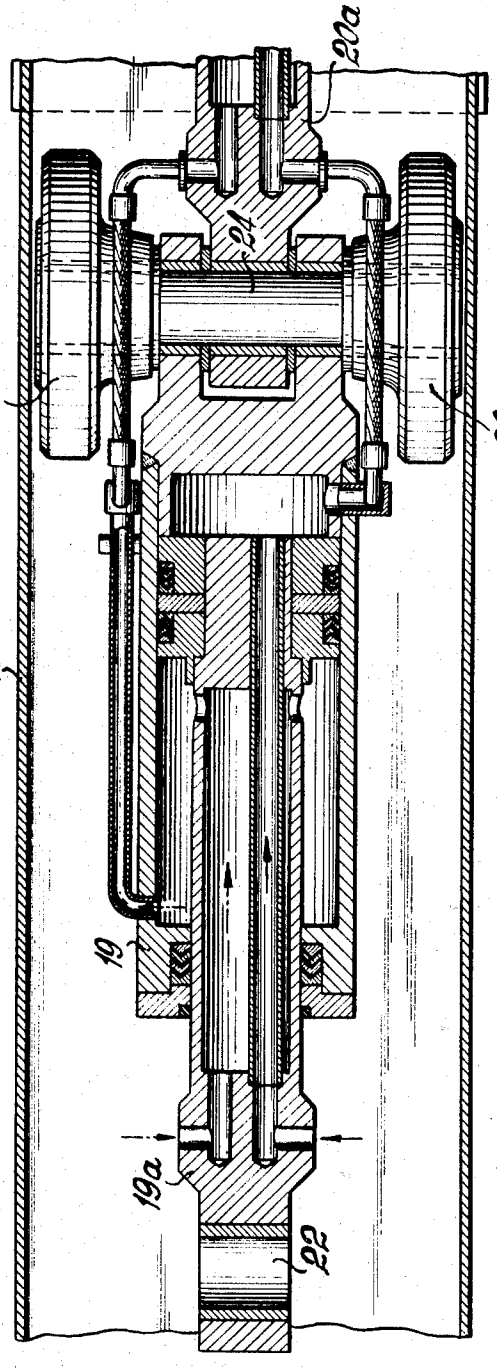


FIG. 4d

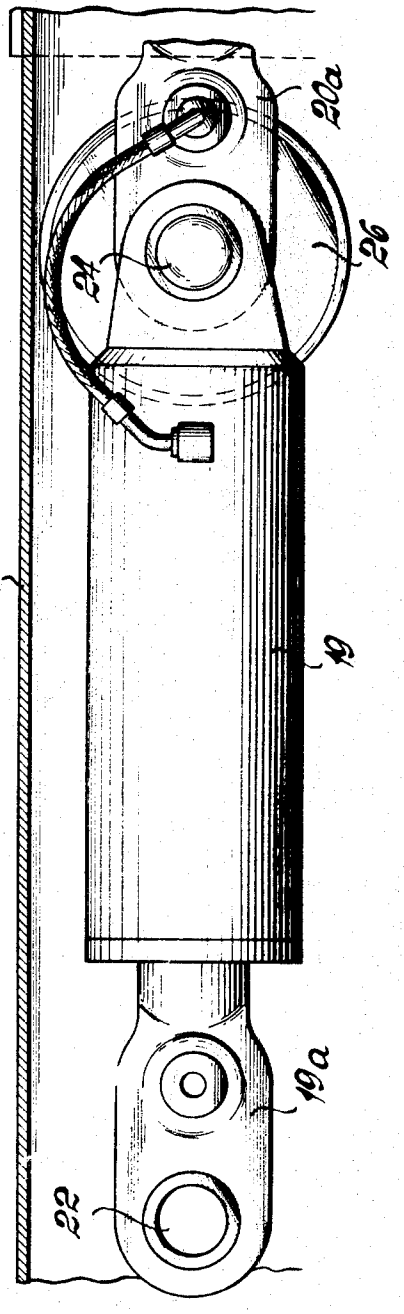


FIG. 4e

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TELESCOPIC BOOM

The present invention relates to a hydraulic actuating mechanism for moving the telescopic parts of a telescopic boom outwardly and inwardly, especially for vehicle cranes. Multiple telescopic booms are employed particularly with vehicle cranes, which are limited as to their length, in order to be able in spite of the relatively short length of the crane in moved-in condition to have available a long boom in moved-out condition.

With telescopic booms of this type, each individual telescopic part has a hydraulic cylinder piston system associated therewith as moving-out element. A telescopic boom consisting of three individual telescopic parts adapted to be moved out is, with heretofore known types of multiple telescopic booms, equipped with three hydraulic cylinder piston systems. When moving out the individual telescopic parts, the hydraulic cylinder piston systems associated therewith likewise move out and thereby bring about a displacement of the center of gravity of the telescopic boom in a direction away from the vehicle. As a result thereof, the stability and the working capability of the crane are influenced in a negative sense because the weight of the hydraulic cylinders which move out considerably beyond the tilting axis of the vehicle and the weight of the telescopic parts greatly increase the tilting moment of the vehicle. The displacement of the center of gravity is all the greater the greater the outward stroke of each individual telescopic part. To this has to be added that with large outward strokes the respective actuating cylinder piston systems will, due to the great unsupported length in view of which buckling occurs, become rather heavy. This in turn brings about that the respective parts moving away from the center of gravity of the vehicle by the length of the outward stroke reduce the carrying ability and the stability of the crane.

It is, therefore, an object of the present invention to provide the telescopic boom of hydraulic cranes with a device for moving-out the telescopic parts, in which considerably smaller hydraulic cylinder piston systems than heretofore customary can be used to thereby reduce the weight thereof and to overcome the above outlined drawbacks.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. **1** is a side view of a crane vehicle with a telescopic boom and actuating mechanism therefor according to the present invention.

FIG. **2** diagrammatically illustrates a side view of a telescopic boom according to the invention.

FIG. **3***a* shows an actuating mechanism for actuating the telescopic parts of a telescopic boom, said actuating mechanism comprising a plurality of sectional cylinders in moved-in condition.

FIG. **3***b* is a view similar to that of FIG. **3***a* but with the cylinders in moved-out condition.

FIG. **4***a* is a side view showing how the sectional cylinders are guided in corresponding housing means.

FIG. **4***b* is a top view showing how the sectional cylinders are guided in the housing means therefor.

FIG. **4***c* shows in section how the sectional cylinders are guided in the housing means therefor.

FIG. **4***d* illustrates a section through the left hand sectional cylinder piston system of FIG. **3***a* but on a larger scale than the latter.

FIG. **4***e* is a top view of FIG. **4***d*.

The hydraulic actuating mechanism according to the present invention for moving-out and moving-in the telescopic parts of a telescopic boom is characterized primarily in that the actuating mechanism acting as a single cylinder is composed of two or more serially arranged and pivotally interconnected sectional cylinder piston systems while the foot point of that cylinder piston system which is adjacent the center of gravity of the telescopic boom is connected to the housing part cooperating with the last mentioned cylinder piston system, while the foot point of that cylinder piston system which is remote from the first mentioned cylinder piston system is connected to the housing part cooperating with the cylinder piston system remote from the first mentioned cylinder piston system. The joints of the sectional cylinder piston systems are provided with sliding members which are displaceable in the guiding housings.

According to a further development of the invention, the guiding of the sectional cylinder piston systems in the guiding housings is realized by providing one joint each between the sectional cylinder piston systems which joint has an axle by means of which the sectional cylinder piston systems are interconnected and on which rollers are mounted for movement in the guiding housings.

Referring now to the drawings in detail, FIG. **1** shows a crane vehicle **1** which supports a telescopic boom **2**. According to the specific showing, boom **2** comprises the three telescopically interengaging boom sections **2***a*, **9** and **10**. Boom **2** is by means of the main boom section **3** and the hydraulic cylinder piston systems **5** and **6** pivotally mounted on the upper structure **4** of the crane vehicle **1**. The pivoting of the telescopic boom with regard to the main boom section **3** is effected in the common pivot axle **7**. To this end, the telescopic boom is provided with an eye **8**. The telescopic parts or boom sections **9** and **10** (see FIG. **2**) are by means of rollers **11** and **12**; **13** and **14** guided in the telescopic boom section **2***a*. The pushing-out and pulling-in of the telescopic boom sections **9** and **10** is effected by the hydraulic actuating mechanisms **15** and **16** which are firmly pivotally connected to the telescopic boom **2** and the telescopic part **9** respectively for effecting the pushing-out and pulling-in of the telescopic sections **9** and **10** respectively.

As will be seen from FIG. **2** and FIGS. **3***a* and **3***b*, the hydraulic actuating mechanisms **15**, **16** comprise guiding housing sections or telescoping elements **17** and **18** having arranged therein three sectional cylinders **19**, **20**, **21**. The free end of the piston rod **19***a* of cylinder **19** is by means of the joint **22** firmly pivotally connected to the guiding housing section **18** and pivotally connects housing section **18** to telescopic boom section **2***a*. The cylinder **20** has the free end of its piston rod **20***a* pivotally connected to the sectional cylinder **19**, whereas the cylinder **21** has the free end of its piston rod **21***a* hingedly connected to the cylinder **20** while the opposite end of the cylinder **21** is by means of the journal **23** pivotally connected to the guiding housing section **17** and the boom section **9**. In order to assure that the sectional cylinders **19**, **20** and **21**, when being

subjected to oil under pressure, will be displaceable within the housing sections or telescoping elements **17** and **18** with a minimum of power consumption, the sectional cylinders **19** and **20** have those ends thereof which are remote from the ends through which the piston rods extend provided with an axle **24** and **25** respectively on which rollers **26**, **27** are rotatably mounted. Instead of the rollers **26** and **27**, also correspondingly designed sliding members (not shown) may be employed. The hydraulic actuating mechanism **16** is built up analogously to the hydraulic mechanism **15**, with pivot shaft **28** pivotally connected to boom section **9**, and with pivot shaft **29** pivotally connected to boom section **10**.

If it is desired to push out the telescopic boom, oil under pressure is conveyed to the sectional cylinders **19**, **20** and **21** of the hydraulic actuating mechanisms **15** and **16** (see solid arrows in FIG. **4***d*), whereas, when the telescopic boom has to be shortened, pressure fluid follows the path indicated by the broken arrows in FIG. **4***d*. In order to prevent the sectional cylinders from a lateral buckling, the sectional cylinders are guidingly surrounded and confined by the guiding housing sections **17**, **18** in which they can easily be displaced in view of the rollers **26** and **27** or sliding members of any standard type.

By subdividing the hydraulic cylinders provided for actuating the individual telescopic profiles, which cylinders heretofore had a rather long stroke, into short serially arranged hydraulic cylinders with considerably shorter strokes, the buckling length of the hydraulic cylinders can be considerably reduced, and this is possible all the more the greater the number of the short hydraulic sectional cylinders **19**, **20**, **21** serially arranged one behind the other.

The hydraulic actuating mechanism according to the present invention which is composed of individual cylinder sections has the advantage of considerably reducing the overall weight and thereby considerably reducing the shifting of the weight when the telescopic boom occupies its fully moved-out position. Moreover, the sectional cylinders can, in view of their considerably reduced buckling length, be subjected to the full operating pressure. In case of any damage, only a cylinder section has to be exchanged whereby the repair costs are greatly reduced. Furthermore, by serially arranging two or more sectional cylinders, the maximum stroke of the telescopic boom can easily be varied in conformity with the respective requirements of the crane involved.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawing but also comprises any modifications within the scope of the appended claims.

What we claim is:

1. In combination with a lifting device comprising a supporting means: a composite boom having a plurality of telescoping boom sections including a main boom section pivotally connected to said supporting means and successive telescoping boom sections including an end boom section telescoping into said main boom section, a plurality of pairs of telescoping elements, each pair having the end of one element fastened to one boom section and the opposite end of the other element connected to the next successive boom section and a plurality of hydraulically operated cylinder-piston means arranged in series and confined within each pair of telescoping elements with the end element of one cylinder-piston means connected to one end of one telescoping element and the end element of another cylinder-piston means connected to the opposite end of the other element, said cylinder-piston means including guide means engaging said telescoping elements to maintain said series of cylinders and pistons in substantial alignment, said series of cylinder-piston means having their cylinders connected to the pistons of the next successive cylinder-piston means.

2. In the combination claimed in claim **1**, the opposite ends of each series of a plurality of cylinder-piston means being connected to the opposite ends of said telescoping elements by the means connecting said telescoping elements to the corresponding boom sections.

3. In the combination in claim **1**, the plurality of cylinder-piston means having said guide means carried by the connections between the respective cylinders and pistons engaging said telescoping elements.

4. In the combination claimed in claim **3**, the connections between said cylinders and pistons including pivot means interconnecting adjacent cylinders and pistons, and said guiding means comprise roller means carried by said pivot means.

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